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Impact of 'HIV-related stigma-reduction workshops' on knowledge and attitude of healthcare providers and students in Central India: A pre- and post-test interventional study

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1 **Impact of ‘HIV-related stigma-reduction workshops’ on knowledge and attitude of**
2 **healthcare providers and students in Central India: A pre- and post-test interventional study**

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1
2
3 **24 Abstract**
4

5 **25 Introduction:** People living with human immunodeficiency virus (HIV) and acquired
6 immunodeficiency syndrome (AIDS) experience stigma and discrimination throughout their life.
7
8 26 The consequences of stigma and discrimination are severe when enacted by healthcare providers
9
10 27 (HCPs) and result in delay or poor adherence to the treatment. Studies have demonstrated universal
11
12 28 stigma amongst HCPs, yet only a few have presented the effect of interventions on the knowledge
13
14 29 and attitude of practising- (doctors and nurses) and future-HCPs (students of healthcare courses).
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20 31 **Objectives:** The primary objective was to evaluate knowledge, attitude and infection risk
21
22 32 perceptions related to HIV/AIDS among practising- and future-HCPs in Central India. Secondly,
23
24 33 the impact of the 'HIV-related stigma-reduction workshop' using a pre- and post-intervention
25
26 34 study design was evaluated.
27
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29

30 35 **Settings and participants:** The study was conducted during January-August 2016 at two tertiary-
31
32 36 care hospitals and three colleges of healthcare courses in Ujjain district of Central India. Overall,
33
34 37 650 individuals; HCPs (clinicians-75, nurses-211), and students (medical-205, nursing-123 and
35
36 38 Diploma in Medical and Laboratory Technology [DMLT]-36); voluntarily participated in the
37
38 39 study.
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43 40 **Intervention:** The interventional workshop contained in 3 sessions and included training in
44
45 41 epidemiology, transmission and treatment of HIV infection, rights of infected persons, duties of
46
47 42 HCPs, and use of standard precautions.
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50
51 43 **Results:** At pre-intervention, DMLT students had the lowest and clinicians the highest knowledge
52
53 44 scores (24% vs 45%). The stigmatised attitude reflected in all groups, lowest among clinicians
54
55 45 (21%) and highest among DMLT students (34%). Improvement in the post-intervention
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3 46 knowledge scores was highest in medical students (36%) and least among clinicians (16%). The
4
5 47 participants' attitude improved between 3% to 17% in all groups.
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8
9 48 **Conclusions:** Significant post-intervention improvements were seen in both knowledge and
10
11 49 attitude in all groups. Students had a higher tendency to improve than the HCPs. Further studies
12
13 50 are needed to conclude that this specific intervention can change long-term behaviour of HCPs.
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15

16 17 51 **Article Summary**

18 19 52 **Strengths and limitations of this study**

- 20
21 53 • The study demonstrate a positive effect of the 'HIV-related stigma-reduction workshop'
22
23 54 educational intervention on knowledge, attitude, and discrimination of HCPs and students
24
25 55 of healthcare courses, towards PLWHA.
- 26
27 56 • The intervention used low-resources, and therefore could be adopted and scaled up to train
28
29 57 HCPs in other similar settings.
- 30
31 58 • As the study was conducted at work places or educational institutes, the responses are
32
33 59 subjected to a social-desirability bias, and thus might result in underestimation of stigma
34
35 60 and discrimination among the participants.
- 36
37 61 • The end-goal of any stigma-reduction intervention is to reduce stigmatizing behaviours,
38
39 62 but as these behaviours are difficult and complex to capture and quantify at the workplace,
40
41 63 we were restricted to capture attitudes as a proxy.
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43 64 • The post-intervention questionnaire was filled in immediately following the intervention.
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45 65 Thus, the long-term effect cannot be claimed.
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68 Introduction

69 The human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS)
70 epidemic is a global challenge. As per an estimation made at the end of 2017, 36.9 million people
71 were either infected by HIV or were living with AIDS, globally. Of these, about 22 million people
72 could access antiretroviral therapy (ART), and 940 000 people died from HIV-related illnesses (1,
73 2). The United Nations' 90-90-90 targets launched in 2014 have become a central pillar of global
74 efforts to end the HIV/AIDS epidemic. The aim is to diagnose 90% of all HIV-positive persons,
75 provide ART for 90% of those diagnosed, and achieve viral suppression for 90% of those treated
76 by 2020. The program estimates to result in 73% of people with HIV achieving viral suppression,
77 a crucial step in ending the AIDS epidemic by 2030 (3). One key aspect of the HIV/AIDS epidemic
78 that is significantly affected by culture and knowledge of HIV transmission is stigma, specifically
79 HIV/AIDS-related stigma. HIV stigma can be described as a socially shared perception of the
80 devalued status of PLWHA (4). The presence of stigma and discrimination against PLWHA at
81 various societal levels fuels the HIV-epidemic, and the consequences are more severe if present
82 among the healthcare providers (HCPs).

83 HCPs are the core and integral part of the healthcare delivery system. HCPs play a pivotal role in
84 creating a positive environment for better health outcomes of PLWHA and preventing viral
85 transmission (5). However, inadequate knowledge about the HIV infection epidemiology among
86 HCPs gives rise to fear and misconceptions about transmission of the infection (6-8). Fear and
87 misconceptions alter the attitude and enhance the development of stigma and discrimination
88 towards PLWHA (9). Some of the major consequences are, delay in seeking healthcare, impaired
89 timely diagnosis, unwillingness to disclose the HIV-status in the community and while seeking
90 healthcare, and delay or non-compliance to the ART (5, 6). Undisclosed HIV status puts the society

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3 91 at higher risk of infection transmission, contributes to increased morbidity and mortality of
4
5 92 PLWHA, increased healthcare costs and burden on the overall healthcare sector (10-12).
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8 93 Therefore, in addition to diagnosis and treatment, provision of discrimination- and stigma-free
9
10 94 healthcare is a prerequisite to achieve the sustainable development target to end the epidemic.

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13 95 In 2016, with the prevalence of 2.1 million PLWHA, India ranked 3rd in the world, after South
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15 96 Africa and Nigeria (13, 14). The prevalence of PLWHA varies state-wise the country. However,
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18 97 the threat of the spread of the infection is high throughout the country due to high inter-state and
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20 98 inter-district migrations (15). Global organisations and governments of high infection risk
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22 99 countries, including Indian, have prioritised stigma-reduction through various interventional
23
24
25 100 programs (16). In India, the National AIDS Control Organization (NACO) advocates the
26
27 101 prohibition of social discrimination against PLWHA (14, 16). NACO has identified seven districts
28
29 102 of the state as high HIV-prevalence districts. Ujjain division is an administrative unit which
30
31
32 103 includes four of these high-risk districts, i.e. Neemuech, Mandsour, Ujjain, and Ratlam (17, 18).
33
34 104 However, the available data from various parts of the country shows that PLWHAs have
35
36 105 experienced stigma and discrimination from the community and the HCPs (19, 20).

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39 106 Educational interventions intended to improve knowledge about HIV/AIDS are effective to reduce
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41 107 the stigma among HCPs and improved healthcare delivery (21-26). The stigma-reduction
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44 108 intervention studies, in general, are time-consuming and resource-intensive. Most of the
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47 109 interventional studies had mainly focused on nurses and nursing students and were not focused on
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49 110 clinicians and students of the healthcare courses (11, 23-25). The students of healthcare courses
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51 111 such as medical, laboratory technician and nursing courses, are future HCPs. It is, therefore,
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53 112 important to develop appropriate interventions to improve the knowledge and reduce HIV-related
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56 113 stigma, targeting both the practising (clinicians and nurses) and future (the students) HCPs (27).

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3 114 However, little is known about HIV/AIDS-related knowledge, attitudes and perceived infection
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5 115 risk of the practising and future HCPs from India.
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8 9 116 **Objectives**

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12 117 To evaluate the knowledge and attitude and infection risk perceptions related to HIV/AIDS, among
13
14 118 the HCPs, and the students of healthcare courses, i.e. medical, laboratory technician and nursing
15
16 119 in Ujjain district in Central India. Further, to assess and compare the impact of the ‘HIV-related
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18 120 stigma-reduction workshop’ intervention on the participant groups using a pre-and post-
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20 121 intervention study design.
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23 24 122 **Methods**

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28 123 This interventional study was conducted between January 2016 and August 2016 at three colleges
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30 124 of healthcare courses and two tertiary-care hospitals in Ujjain district in Madhya Pradesh state in
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32 125 India. One of the hospitals is located in a rural area and is associated with all three colleges included
33
34 126 in the study. One of the two study hospitals is associated with a medical college, a nursing college
35
36 127 and a DMLT college. This hospital is referred as teaching hospital (TH), and the students of
37
38 128 Bachelor of Medicine, Bachelor of Surgery (MBBS), are referred as medical students in the present
39
40 129 communication. An ART centre is located at the TH with specialized healthcare facilities for the
41
42 130 PLWHA. Another participating hospital is located in Ujjain city, referred to as a non-teaching
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44 131 hospital (NTH).
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49 132 **Participants**

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3 133 The participants were practicing HCPs clinicians and nurses, and future HCPs, i.e. students of
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5 134 medical, nursing and Diploma in Medical and Laboratory Technology [DMLT] courses, enrolled
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8 135 in respective institutes in Ujjain district of Central India.
9

10 136 **Sampling strategy**

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13 137 All groups of the HCPs and students were invited to participate in the workshop through various
14
15 138 means such as leaflets posted at the notice boards, announcements during lectures or meetings.
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17 139 The leaflets were written in Hindi and English to offer equal chances for all potential participants
18
19 140 to learn about and attend the workshop to enhance their HIV/AIDS-related knowledge and ways
20
21 141 to stay protected at the workplace. The workshops were conducted at respective colleges and
22
23 142 hospitals for providing ease to participate.
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28 143 **Inclusion and exclusion criteria**

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31 144 Participation was voluntary, and the participant could leave the session at any time without
32
33 145 experiencing any repercussions. Participants who could not attend or complete both pre- and post-
34
35 146 workshop sessions were not included in the analysis (Figure 1).
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39 147 **Figure 1 Inclusion and exclusion criteria of the study participants (make in 1,200 dpi)**

40 148 **Intervention**

41 149 *Structure of the workshops*

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46 150 All workshops were conducted by the same facilitators: a clinician and an officer-in-charge of the
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48 151 ART centre at the TH and the leader of hospital infection prevention and control team at the TH
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51 152 and the NTH. In total, 13 workshops were conducted. Participants were divided into smaller
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3 153 subgroups as follows: clinicians (2 groups), nurses (5 groups), medical students (3 groups), nursing
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5 154 students (2 groups) and DMLT students (1 group) to ensure that they feel comfortable in the
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8 155 learning environment.
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10 11 156 *Content of the workshops*

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14 157 The workshop was 2 hours long and was divided into three sessions: the 1st session consisted of
15
16 158 an animated video demonstrating the HIV infection epidemiology, mechanism of viral
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19 159 transmission, diagnostic testing, treatment options, mechanism of action of ART drugs and ethical
20
21 160 issues related to PLWHA and ART. This was followed by 2nd session with a powerpoint
22
23 161 presentation focusing the topics such as rights of PLWHA, duties of HCPs and predictable
24
25 162 consequences due to stigma and discrimination against PLWHAs. The 3rd session was more
26
27 163 interactive and dynamic. In this part, information about universal precautions and preventive
28
29 164 measures for infection prevention and control was provided, describing the importance of the use
30
31 165 of standard precautions, including hand hygiene in daily routine. It was explained how and when
32
33 166 to use gowns, gloves, face shields, masks and goggles, availability of post-exposure prophylaxis
34
35 167 (PEP) in the study settings and use of in-house prepared alcohol-based hand rub, i.e. ‘Micro
36
37 168 *Kavach*’ (28). This was followed by the demonstration and practice of the WHO recommended
38
39 169 hand hygiene techniques using ‘Micro *Kavach*’ (28). A time period of 15 to 20 minutes was
40
41 170 assigned for open discussion that was followed by filling-up the post-intervention questionnaires.
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47 171 **Data collection and analysis**

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50 172 The context-specific pre- and post-intervention questionnaires were developed locally and used as
51
52 173 data collection tools. The questionnaires were pre-tested in each potential participant groups and
53
54 174 modified based on the received feedback. Questionnaires were formatted in both English and
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3 175 Hindi, divided into following sections: (1) participants' demographic information, (2) experiences,
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5 176 (3) HIV/AIDS-related knowledge, (4) attitudes towards PLWHA, (5) risk perception and
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7 177 willingness to provide care to PLWHA and patients with Hepatitis B.
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10
11 178 The participants were asked to fill in the questionnaire once before the workshop (pre-intervention)
12
13 179 and once 20 minutes after the workshop (post-intervention).
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17 180 The authors scored the responses related to the knowledge and attitude questions. Each correct
18
19 181 response in the knowledge section received a score of one, and each incorrect response received a
20
21 182 score of zero. Scores of each individual were added and converted to the percentage of correct
22
23 183 responses pre and post-intervention. Based on the previous research in this field levels of
24
25 184 knowledge were categorised into "low" for participants who scored 50% and below, "moderate"
26
27 185 for those who scored between 51% and 74%, and "high" for those who scored 75% and above
28
29 186 (29).
30
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34 187 The responses to the questions related to the participants' attitude towards PLWHA were classified
35
36 188 into three categories: positive (non-stigmatizing), unsure and negative (30). A positive response
37
38 189 was given a score of one and the responses where the participants were unsure or, where the
39
40 190 responses indicated negative attitude including fear, stigma, or intent to discriminate PLWHA,
41
42 191 were given a score of zero (31). Scores of the participants were added and converted to the
43
44 192 percentage of correct responses pre- and post-intervention. Question for which the missing data
45
46 193 was higher than 50% were excluded from the analysis.
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51 194 Risk perception questions were categorical and dichotomised according to the outcome of interest
52
53 195 for example (a) I am willing or not willing to care for a patient, or (b) I am at high risk or not at
54
55 196 high risk of HIV exposure at the workplace.
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197 **Statistical analysis**

198 The data on demographic and basic HIV-related information is presented as mean and standard
199 deviations for continuous variables and as percentages and frequencies for categorical variables.
200 The knowledge, attitudes and work environment variables are presented as median with
201 interquartile range (IQR). The difference between the pre- and post-intervention scores were
202 analysed using a Wilcoxon signed-rank test for continuous variables and McNemar's test for
203 categorical variables. The score difference was calculated by subtracting the pre-intervention
204 (baseline) score from the post-intervention score and represents the percentage unit increase or
205 decrease in relation to the baseline score. As these scores were not normally distributed, a Kruskal-
206 Wallis test was conducted to determine a statistically significant difference among the participant
207 groups in pre-intervention and post-intervention scores as well as the difference of scores. Post-
208 hoc Dunn's tests were conducted to evaluate the relationship between the groups. The statistical
209 significance was set at the level of $p < 0.05$. Data collected in the questionnaires were entered using
210 Epidata software (version 3.1) and Microsoft Excel. Statistical analysis was performed using the
211 Statistical Package for the Social Sciences (SPSS and STATA) software.

212 **Results**

213 **Baseline characteristics**

214 A total of 920 invited persons, 746 participants (81%) voluntarily participated in the study. Out of
215 746 participants, 650 attended all intervention sessions and filled-in both pre- and post-intervention
216 questionnaires. Of 650 participants, 56% were students, and 44% were practising HCPs. Thus, the
217 data of 650 participants were included in the analysis (Figure 1).

218 **Figure 2 Inclusion and exclusion criteria of the study participants**

219

220 The mean age of the participants was 23 years, the majority were of the Hindu faith, and 56% were
 221 males (Table 1). The proportion of participants who had received HIV/AIDS-related training
 222 previously, varied from 4% in the clinician group to 78% in the DMLT student group. Only 2% of
 223 medical students stated that they had worked with PLWHA before. A high proportion of
 224 participants in each group reported an experience of accidental exposure to HIV or PLWHA. A
 225 range of 9% to 20% of the participants admitted discriminating against PLWHA at workplaces.
 226 Six (3%) of medical students and up to 11% of DMLT students admitted that they had refused to
 227 provide care for PLWHA during their scheduled clinical visits. A range of 17% to 28% of
 228 participants thought that their colleagues discriminate against PLWHA (Table 1).

230 **Table 1 Baseline demographic information (Part A) and experiences (Part B) of the**
 231 **participants**

	Clinicians (n=75)	Nurses (n=211)	Medical students (n=205)	Nursing students (n=123)	DMLT students (n=36)
Part A: Baseline demographic information					
Age, mean (SD)	28 (4)	25 (6)	20 (1)	21 (3)	20 (2)
Sex, n (%)					
Male	30 (40)	148 (71)	109 (53)	51 (42)	28 (78)
Female	45 (60)	63 (30)	96 (47)	72 (59)	8 (22)
Married, n (%)	21 (28)	70 (33)	-	11 (9)	35 (97)
Religion, n (%)					
Hindu	62 (83)	192 (91)	183 (89)	120 (98)	31
Muslim	2 (3)	5 (2)	6 (3)	3 (2.4)	4
Christian	2 (3)	10 (5)	1 (0.5)	-	-
Other	9 (12)	4 (2)	15 (7)	-	2
Have you ever attended any HIV/AIDS related training?	3 (4)	39 (18)	63 (31)	28 (23)	28 (78)
Part B: Experiences of participants					
Have you ever cared for PLWHA before? n (%)	37 (49)	121 (57)	4 (2)	88 (72)	18 (50)
If yes, how many times?					
< 10	29 (78)	59 (49)	2 (50)	61 (69)	5 (28)
< 50	2 (5)	27 (22)	-	14 (20)	8 (44)
> 100	1 (3)	19 (16)	-	-	5 (28)
Cannot recall the numbers	-	16 (13)	2 (50)	13 (15)	-
§Have you ever had an accidental exposure with body fluid of PLWHA at work?	§4 (11)	§24 (20)	§3 (75)	§14 (16)	§1 (6)
Have you ever refused to care for PLWHA?	6 (8)	18 (9)	6 (3)	6 (5)	4 (11)
Have you discriminated against PLWHA at the workplace?	7 (9)	42 (20)	22 (11)	13 (11)	5 (19)

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3						
4	Do you think your colleagues discriminate against PLWHA?	21 (28)	45 (21)	51 (25)	28 (23)	6 (17)
5	Is your family aware that you ought to care for PLWHA patients as well	49 (65)	134 (64)	127 (62)	100 (81)	16 (72)
6	Is there any family pressure regarding caring for PLWHAs	15 (20)	46 (22)	16 (8)	15 (12)	8 (22)
7	Do you have any friend or family who is identified as PLWHA?	3 (4)	16 (8)	3 (2)	5 (4)	2 (6)
8	There is enough equipment to maintain universal precautions at work place.	20 (27)	126 (60)	79 (39)	84 (68)	19 (53)
9	Have you ever had any accidental exposure to HIV through PLWHA at work?	4 (5)	24 (11)	3 (1)	14 (11)	1 (3)
10						
11						
12						
13						

232 DMLT= Students of Diploma in Medical and Laboratory Technology; Medical students= Students of Bachelor of
 233 Medicine, Bachelor of Surgery; PLWHA= people living with HIV/AIDS

234 The boxes where totals do not add up to 100%, the remaining percentage of the participants did not respond to that
 235 question. §Proportion calculated from patients who confirmed that they have ever cared for PLWHA
 236

237 **Impact of the intervention on knowledge scores**

238 Pre-intervention knowledge score, presented as the percentage of correct responses, showed the
 239 low overall level of knowledge with the poorest in DMLT students (22%) and the highest among
 240 the clinicians (45%, Table 2). Post-intervention knowledge scores ranged from 48% in the nurses'
 241 group to 64% in the medical students' group. The post-intervention knowledge scores were
 242 significantly higher than pre-intervention knowledge scores ($p < 0.001$, Table 2), and almost all
 243 groups reached a moderate level of knowledge. The difference between knowledge scores of all
 244 study groups was statistically significant ($p < 0.001$). The knowledge scores of the students of both
 245 medical and nursing courses improved more than their respective practising HCPs. Pairwise
 246 comparison showed that at the pre-intervention stage, the clinicians had the highest knowledge
 247 than the rest of the groups ($p < 0.001$, Table 3). However, in the post-intervention stage, the medical
 248 students presented higher knowledge than the clinicians while the knowledge of nurses was lowest
 249 in the sequence.

250 **Impact of the intervention on attitude**

251 Evidence of stigmatised attitude was observed among all responder groups. The lowest level of
 252 stigmatising attitudes at pre-intervention was found in the clinicians' group, where 79% responded

253 to the questions without stigma. On the other hand, in the DMLT students' group, only 66% of
 254 responses presented a non-stigmatising attitude (Table 2). In post-intervention, the percentages of
 255 non-stigmatising responses were higher, ranging from 79% (lowest) among the nurses to 84% in
 256 the medical students' group. The attitude improved significantly across all groups, with 3% in the
 257 clinician group and 17% in the DMLT students' group ($p < 0.001$). Overall, the intervention resulted
 258 in an improvement in stigma levels to 21%, as shown in the nurses' group. Pairwise comparison
 259 showed that medical students had the highest improvement in their attitude compared to the nurses,
 260 nursing students, as well as the clinicians (Table 4).

261 **Table 2. Pre- and post-intervention scores of knowledge and attitude among the participant**
 262 **groups**

Knowledge					
	Clinicians (n=75) % (IQR)	Nurses (n=211) % (IQR)	Medical students (n=205) % (IQR)	Nursing students (n=123) % (IQR)	DMLT students (n=36) % (IQR)
Percentage of correct responses					
Pre-Intervention, median (IQR)	45 (15)	30 (19)	29 (14)	30 (19)	22 (14)
Post-Intervention, median (IQR)	59 (14)	48 (26)	64 (21)	59 (26)	52 (17)
Difference	14*	18*	35*	29*	30*
Attitude					
Percentage of responses without stigma					
Pre-Intervention, median (IQR)	79 (18)	74 (15)	74 (18)	76 (12)	66 (35)
Post-Intervention, median (IQR)	82 (11)	79 (12)	84 (16)	82 (9)	83 (14)
Difference	3*	5*	10*	5*	17*

*Statistically significant differences with significance level $p < 0.05$.

DMLT= Students of Diploma in Medical and Laboratory Technology; IQR= Interquartile range; Medical students= Students of Bachelor of Medicine, Bachelor of Surgery

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 268 **Table 3. Pre- and post-intervention pairwise comparison of knowledge between the**
 269 **participant groups**

Groups Compared	Pre-Intervention Adjusted significance	Post-Intervention Adjusted significance	Pre- and Post-Intervention Adjusted significance

DMLT students- Nursing students	<0.05*	0.068	1.000
DMLT students - Medical students	<0.01*	<0.001*	0.629
DMLT students -Clinicians	<0.001*	0.116	<0.001*
DMLT students - Nurses	0.059	1.000	0.234
Medical students - Clinicians	<0.001*	0.051	<0.001*
Nursing students - Clinicians	<0.001*	1.000	<0.001*
Nursing students – Medical students	1.000	<0.05*	0.934
Nurses- Nursing students	1.000	<0.001*	<0.001*
Nurses- Clinicians	<0.001*	<0.001*	<0.05*
Nurses– Medical students	1.000	<0.001*	<0.001*

*Statistically significant differences with significance level $p < 0.05$.

Significance values have been adjusted by the Bonferroni correction for multiple tests. DMLT= Students of Diploma in Medical and Laboratory Technology; Medical students= Students of Bachelor of Medicine, Bachelor of Surgery

Table 4. Pre- and post-intervention pairwise comparison of attitudes between the participant groups

Groups Compared	Pre-Intervention Adjusted significance	Post-Intervention Adjusted significance	Pre- and Post-Intervention Adjusted significance
DMLT students - Nursing students	0.184	1.000	0.147
DMLT students - Medical students	0.479	0.614	1.000
DMLT students -Clinicians	<0.01*	1.000	0.134
DMLT students - Nurses	0.627	1.000	0.439
Medical students - Clinicians	<0.05*	1.000	<0.01*
Nursing students - Clinicians	0.252	1.000	1.000
Nursing students – Medical students	1.000	0.173	<0.01*
Nurses- Nursing students	1.000	0.614	1.000
Nurses- Clinicians	<0.05*	0.092	1.000
Nurses– Medical students	1.000	<0.001*	<0.05*

*Statistically significant differences with significance level $p < 0.05$. Significance values have been adjusted by the Bonferroni correction for multiple tests.

DMLT= Students of Diploma in Medical and Laboratory Technology; Medical students= Students of Bachelor of Medicine, Bachelor of Surgery

Table 5. Risk perception reported by the participants in pre- and post-intervention questionnaires: Proportion of the participants who responded as “Yes” to the questions asked

Questions	Time point	Nurses (n=211) n (%)	Clinicians (n=75) n (%)	Nursing students (n=123) n (%)	Medical students (n=205) n (%)	DMLT students (n=36) n (%)
Do you think you are at high risk for HIV/AIDS at work?	Pre-intervention	71 (34)	50 (67)	39 (32)	61 (30)	22 (61)
	Post-intervention	81 (38)	51 (68)	86 (70)*	82 (40)*	17(47)
Are you willing to care for- a) Patients with hepatitis B	Pre-intervention	174 (83)	64 (85)	112 (91)	155 (76)	28 (78)
	Post-intervention	192 (91)*	65(87)	118 (96)	196 (96)*	32 (89)
b) PLWHA§	Pre-intervention	151 (72)	65 (87)	114 (93)	179 (87)	34 (94)
	Post-intervention	175 (83)*	66 (88)	110 (89)	183 (89)	30 (83)

286 *Statistically significant differences with significance level $p < 0.05$. DMLT= Students of Diploma in Medical and
 287 Laboratory Technology; Medical students= Students of Bachelor of Medicine, Bachelor of Surgery; PLWHA= People
 288 living with HIV/AIDS. §The question was also classified as an attitude question.

289

290 **Impact of the intervention on infection risk perception**

291 Thirty per cent of medical students and 67% of the clinicians perceived themselves to be at high
 292 risk of HIV infection in their workplace at the pre-intervention stage. Willingness to care for
 293 PLWHA was relatively high at the pre-intervention, ranging from 72% among the nurses to 94%
 294 among the DMLT student group. The proportion of participants who were willing to care for
 295 people living with Hepatitis B was similar to those willing to care for PLWHA.

296 After the workshop, the medical and nursing student reported a significant increase in awareness
 297 of risk perception of HIV infection compared to their statements at pre-intervention. There was a
 298 significant increase in post-intervention willingness to care for PLWHA in the nursing group, and
 299 a non-significant decrease in the DMLT and nursing students' group (Table 5).

300

301 **Discussion**

302 The present study evaluates the effect of 'HIV-related stigma-reduction workshops' and showed
 303 that there was a significant improvement in HIV/AIDS-related knowledge in all groups who
 304 participated in the intervention irrespective of their inadequate baseline knowledge. Our study
 305 highlights that stigmatising attitudes are widespread among practising HCPs and students of

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2
3 306 various healthcare courses. However, this stigmatising attitude and discrimination to provide
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5 307 medical care to PLWHA reduced significantly among the participants after the intervention. The
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8 308 student groups showed more receptiveness to improve their knowledge and attitudes towards
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10 309 PLWHA than the practising HCPs.

13 310 *Knowledge*

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17 311 Overall, the study participants had inadequate HIV/AIDS-related knowledge, and the clinicians
18
19 312 had the highest pre-intervention knowledge score among all groups. The low level of knowledge
20
21 313 presented in our study is comparable with results from a cross-sectional survey conducted among
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23 314 consultants, residents, medical students, laboratory technicians, and nurses, in Uttarakhand, India
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25 315 (32). In this study, the clinicians had better knowledge than the rest of the groups, while the overall
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28 316 knowledge was not complete.

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32 317 The implication of acquired knowledge and attitudes are complex, but theories suggest that
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34 318 knowledge is associated with baseline beliefs and attitudes and depends on the readiness of the
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36 319 learners and their willingness to integrate the change into their behaviour (33, 34). Our study
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38 320 showed the lowest increase in post-intervention knowledge scores among clinicians and the
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41 321 highest increase among the student groups. This could be due to several factors. Firstly, clinicians
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43 322 showed adequate knowledge at pre-intervention, thus had less scope to improve their knowledge
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45 323 at post-intervention. Secondly, as per the educational theory; the recognition of the gap in
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47 324 knowledge, skills, or the need for behaviour change is essential for the desired change (33, 34).
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49 325 The student groups, being in the learning phase of life, may have been more receptive to the
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52 326 training from the beginning and, thus improved more than the rest of the groups (33, 34).
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3 327 In our study, the overall knowledge scores increased substantially after intervention in all groups
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5 328 ranging, from 14% in clinicians to 35% in the medical students' group. Two single centre studies
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7 329 conducted among nursing students in Bengaluru and nurses in Delhi, India evaluated the effect of
8
9 330 a brief stigma-reduction curriculum and educational intervention on HIV knowledge (23, 25). In
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11 331 Bengaluru, the intervention was divided into two sessions of 1-hour each while in Delhi; it was a
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13 332 2-days training program. The educational intervention delivered showed significant improvement
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15 333 in knowledge scores in both settings. An increase of 9% post-intervention knowledge in Bengaluru
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17 334 and 22% in Delhi was presented.

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22 335 Although, in both studies, the participants attended two educational sessions, contrary to our single
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24 336 workshop; the improvement in our study was higher. Therefore, it could be inferred that the
25
26 337 number and duration of the educational workshops do not correspond to improve the knowledge.

30 338 *Attitude*

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34 339 The percentage of non-stigmatizing responses ranged from 66% in the DMLT students to 79%
35
36 340 among the clinicians. Although the presence of stigma and discrimination was visible in the pre-
37
38 341 intervention attitude scores across all participant groups, the results are comparable to the
39
40 342 previously mentioned cross-sectional study by *Doda et al.* in Uttarakhand, India where the median
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42 343 of positive responses ranged from 69% in postgraduate residents to 92% in consultants (32).

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46 344 Professional experience in working with PLWHA is a predictor of more positive attitudes towards
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48 345 PLWHA (14,27). The higher levels of stigmatising attitudes found among participants (students)
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50 346 in our study could be due to incomplete or inadequate knowledge, and also relatively less
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52 347 experience of working with PLWHA.

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3 348 One of the primary outcomes of our workshops was the reduction of negative attitudes ranging
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5 349 from 3% in clinicians to 17% in DMLT students. Our results are comparable with a study from
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7 350 China among clinicians, nurses, and laboratory technicians (35) which showed 13% and 22%
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9 351 reduction in stigmatising attitudes at 6 and 12 months respectively after the intervention. On the
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11 352 other hand, the reduction presented in our study is lower than the average reduction shown in a
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13 353 study from Pune, India (33%). The Pune based study examined the impact of a 4-day long
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15 354 HIV/AIDS health education program on the knowledge and positive attitudes toward caring for
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17 355 HIV-infected patients of nurses (24).
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22 356 *Risk perception*

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26 357 Another highlight of our study was willingness shown by the majority of HCPs and students, to
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28 358 care for PLWHA, ranging from 72% to 94%, at the pre-intervention stage. Our findings are in line
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30 359 with a study conducted in India by *Kermode et al.* showing a relatively high willingness of HCPs
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32 360 to care for PLWHA in spite of the presence of the stigmatising attitudes (7). However, our results
33
34 361 differ from the studies conducted in Russia, showing that only 20% of HCPs were willing to care
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36 362 for PLWHA (20%) (36).
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41 363 Medical and nursing students significantly improved their awareness of being at risk for
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43 364 HIV/AIDS at work. The willingness of the participants to change behaviour might have influenced
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45 365 this improvement. There is a lack of studies that had assessed the pre- and post-intervention risk
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47 366 perception among HCPs. There was an interplay between the knowledge of risks and universal
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49 367 precautions in our study, actual risk (due to the prevalence of HIV and job description), the
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51 368 environmental barriers and lack of accessibility of protective equipment. This interplay point
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53 369 towards a need for structural changes at the workplace in conjunction with customised educational
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3 370 interventions to reduce risk perception (6, 7). Further studies are needed to determine the factors
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5 371 affecting willingness among HCPs to care for PLWHA.
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8 9 372 **Conclusions**

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12 373 Combating stigma is a key priority to achieve success in epidemic control and providing quality
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14 374 care to PLWHA. The findings from this study show that the 'HIV-related stigma-reduction
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16 375 workshops' - a brief and relatively low resource intervention successfully increased knowledge
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18 376 and reduced stigma in both HCPs and students.

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22 377 We, therefore, recommend repetitive conduction of such contextualized workshops at healthcare
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24 378 facilities. Attention must be drawn to interventions focusing on stigma-reduction that can be scaled
25
26 379 up and transferred to multiple HCPs groups, including both practicing- and future-HCPs. We also
27
28 380 recommend to conduct similar contextualized workshops in other settings to explore sustainability
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30 381 and evaluate the impact in those settings. Incorporate more practical issues effectively in the
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32 382 teaching curricula of all healthcare courses, is of high importance. Moreover, the inclusion of the
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34 383 qualitative component, the use of extended follow-up and adding behavioural assessment in future
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36 384 studies is recommended to understand participants' attitudes and willingness to change the
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38 385 stigmatising behaviour for PLWHA.
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51 389 data management.
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54 55 390 **Footnotes**

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3 391 **Author contributions**
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6 392 MS and BLB perceived the study. MS and BLB designed and performed the questionnaire and the
7
8 393 content of the interventions, and collected the pre-and post-intervention data. AM, CB and MS
9
10 394 performed the analysis. AM and MS drafted the article. AM, MS, BLB and CB gave critical
11
12 395 comments to modify the manuscript. All authors gave final approval to the present version for
13
14 396 publication.
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25 399 **Competing interests**
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29 400 Authors have no conflicts of interests to declare.
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32 401 **Ethical considerations**
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35 402 Ethical approval was granted by the local ethics committee (311/17-07-2013 and 249/23-01-2013).
36
37 403 Verbal and written consents were obtained from each participant before the study. Participants
38
39 404 were assured by the researchers for full confidentiality. Participants were encouraged to respond
40
41 405 to the questionnaires fearlessly and were ensured for no repercussions based on the responses.
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47 407 **A data sharing statement**
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49 408 The data are not publicly available at present because it contains information that could
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51 409 compromise the confidentiality or consent of the study participants.
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3 411 **Patient consent for publication**
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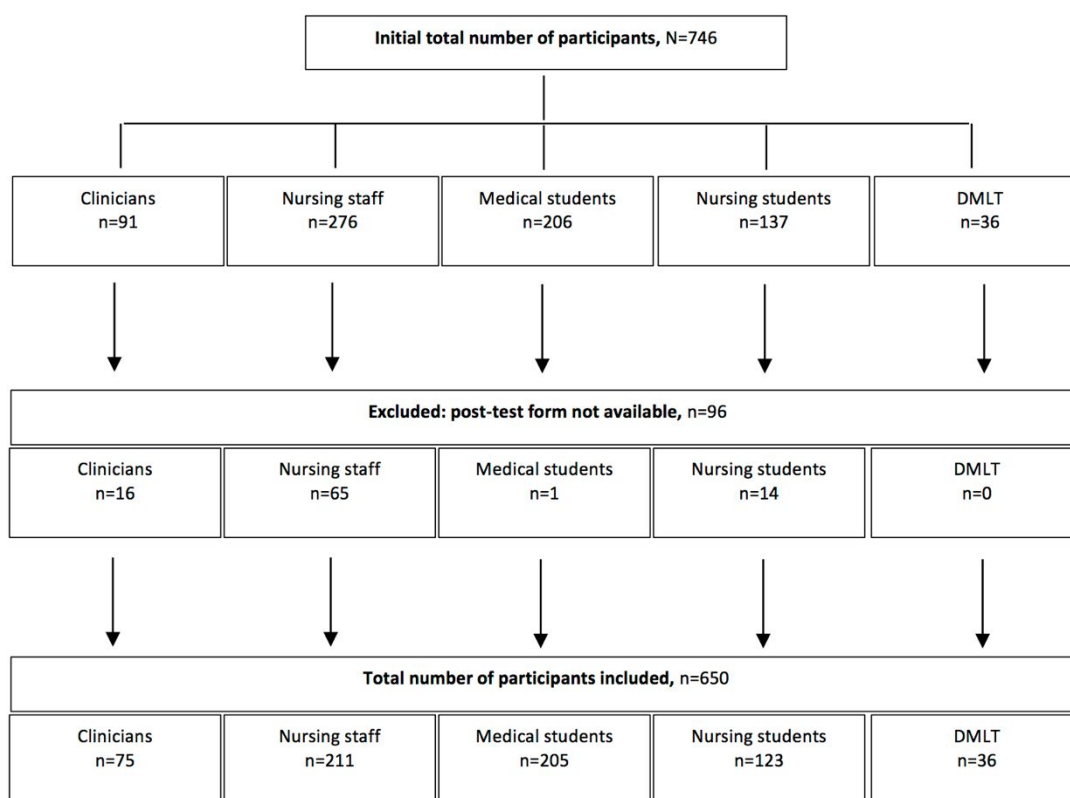
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For peer review only

Figure 1 Inclusion and exclusion criteria of the study participants

DMLT= Students of Diploma in Medical and Laboratory Technology, Medical students= Students of Bachelor of Medicine, Bachelor of Surgery

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Primary Subject Heading:	Medical education and training
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Keywords:	People living with HIV/AIDS, Stigma and discrimination, Health Care Professionals, HIV-related stigma-reduction workshop, Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, MEDICAL EDUCATION & TRAINING

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1 **Impact of ‘HIV-related stigma-reduction workshops’ on knowledge and attitude of**
2 **healthcare providers and students in Central India: A pre- and post-test intervention study**

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24 **Abstract**

25 **Introduction:** People living with human immunodeficiency virus (HIV) and acquired
26 immunodeficiency syndrome (AIDS-PLWHA) experience stigma and discrimination throughout
27 their life. The consequences of stigma and discrimination are severe when enacted by healthcare
28 providers (HCPs), and result in a delay in or poor adherence to treatment. Studies have
29 demonstrated the universal presence of stigmatising behaviours among HCPs, yet only a few have
30 presented the effect of interventions on the knowledge and attitude of practising (doctors and
31 nurses) and future HCPs (students).

32 **Objectives:** To evaluate knowledge, attitudes and infection risk perceptions related to HIV/AIDS
33 among practising and future HCPs in Central India. In addition, the impact of the ‘HIV-related
34 stigma-reduction workshop’ using a pre-and post-intervention study design was evaluated.

35 **Settings and participants:** The study was conducted in 2016 at two tertiary-care hospitals and
36 among three healthcare colleges in Central India. Overall, 650 HCPs (75 clinicians and 211 nurses)
37 and students (205 medical, 123 nursing and 36 Diploma in Medical and Laboratory Technology
38 [DMLT]) voluntarily participated in the study.

39 **Intervention:** The educational intervention comprised of training in epidemiology, the
40 transmission and treatment of the HIV infection, the rights of PLWHA, the duties of HCPs and the
41 use of standard precautions.

42 **Results:** At pre-intervention, DMLT students had the lowest and clinicians the highest knowledge
43 scores (24% and 45% respectively). The stigmatised attitude was reflected in all groups, the lowest
44 among clinicians (21%) and the highest among DMLT students (34%). Improvement in the post-

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3 45 intervention knowledge scores was the highest in medical students (36%) and the lowest among
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5 46 clinicians (16%). The participants' attitudes improved between 3% and 17% across all groups.
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9 47 **Conclusions:** Significant post-intervention improvements were seen in both knowledge and
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11 48 attitudes in all groups. Students had a higher tendency to improve than HCPs. Further long-term
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13 49 studies are needed to evaluate the sustainability of the improvements.
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16 50 **Article Summary**

17 51 **Strengths and limitations of this study**

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19 52 • A context-specific educational intervention was implemented to improve knowledge and
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21 53 attitudes among HCPs and students towards PLWHA.
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24 54 • The study was conducted at two hospitals and three educational institutes where the
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26 55 participants work and/or study. Thus, we may observe a social desirability bias, resulting
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28 56 in the underestimation of stigma and discrimination among the participants.
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31 57 • The end goal of any educational intervention is to reduce stigmatising behaviours, but
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33 58 behaviour change is a long-term process that is complex to capture and quantify; thus,
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35 59 attitudes were captured as a proxy.
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38 60 • The post-intervention questionnaire was completed immediately after the intervention due
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40 61 to feasibility reasons. Thus, we cannot claim the sustainability of the positive effect of the
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42 62 intervention.
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45 63 • Additional follow-ups would provide stronger evidence of the long-term positive impact
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47 64 of the study on attitudes and knowledge.
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51 65 **Introduction**

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3 66 The human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS)
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5 67 epidemic is a global challenge. At the end of 2017, it was estimated that 36.9 million people were
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7 68 either infected by HIV or living with AIDS (PLWHA) globally. Of these, about 22 million people
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9 69 could access antiretroviral therapy (ART), and 940,000 people had died from HIV-related illnesses
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11 70 (1, 2). The United Nations' 90-90-90 targets launched in 2014 have become a central pillar of
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13 71 global efforts to end the HIV/AIDS epidemic. The aim is to diagnose 90% of all HIV-positive
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15 72 persons, provide ART for 90% of those diagnosed and achieve viral suppression for 90% of those
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17 73 treated by 2020. The program aims to result in 73% of people with HIV achieving viral
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19 74 suppression, a crucial step in ending the AIDS epidemic, by 2030 (3). Stigma, specifically
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21 75 HIV/AIDS-related stigma, is one of the key aspects of the HIV/AIDS epidemic. This stigma can
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23 76 be described as a socially shared perception of the devalued status of PLWHA (4). The presence
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25 77 of stigma and discrimination against PLWHA at various societal levels fuels the HIV epidemic,
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27 78 and the consequences are more severe if the stigma is present among healthcare providers (HCPs).
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34 79 Healthcare providers are the core and integral part of the healthcare delivery system, and play a
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36 80 pivotal role in creating a positive environment for better health outcomes for PLWHA and
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38 81 preventing viral transmission (5). However, inadequate knowledge about the HIV infection
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40 82 epidemiology among HCPs gives rise to fear and misconceptions about transmission of the
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42 83 infection (6-8). Fear and misconceptions alter attitudes and enhance the development of stigma
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44 84 and discrimination towards PLWHA. Some of the major consequences of this are delays in seeking
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46 85 healthcare, less timely diagnosis, an unwillingness to disclose the HIV status in the community
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48 86 and while seeking healthcare and a delay in or non-compliance to the ART. Not disclosing an HIV
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50 87 status puts society at higher risk of infection transmission, contributes to the increased morbidity
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52 88 and mortality of PLWHA, increases healthcare costs and places a burden on the healthcare sector
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3 89 overall (9-11). Therefore, in addition to the diagnosis and treatment, provision of discrimination-
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5 90 and stigma-free healthcare is a prerequisite for achieving the sustainable development target
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8 91 designed to end the epidemic (12).
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11 92 In 2016, with a prevalence of 2.1 million PLWHA, India was ranked third in the world after South
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13 93 Africa and Nigeria (13, 14). Although the prevalence of PLWHA varies between states in the
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15 94 country, the threat of the infection spreading is high throughout the country due to high levels of
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17 95 inter-state and inter-district migration (15). Global organisations and governments in countries
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19 96 with a high infection risk, including India, have prioritised stigma-reduction through various
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21 97 intervention programs (16). In India, the National AIDS Control Organisation (NACO) advocates
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23 98 the prohibition of social discrimination against PLWHA (14, 16). The organisation has identified
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25 99 seven districts as having high HIV-prevalence; Ujjain is an administrative unit that includes four
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27 100 of these high-risk districts (Neemuech, Mandsour, Ujjain and Ratlam) (17, 18). However, the data
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29 101 available in various parts of the country shows that PLWHA have experienced stigma and
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31 102 discrimination from the community and HCPs (19, 20).
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37 103 Educational interventions intended to improve knowledge of HIV/AIDS are effective in reducing
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39 104 stigma among HCPs and improving healthcare delivery (12, 21-25). Stigma-reduction intervention
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41 105 studies are, in general, time-consuming and resource-intensive, and most of them have mainly
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43 106 focused on nurses and nursing students, and not on clinicians and healthcare students (10, 22-24).
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45 107 However, medical, laboratory technician and nursing students are future HCPs, which means it is
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47 108 important to develop appropriate interventions to improve their knowledge and reduce their HIV-
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49 109 related stigma while targeting both practising (clinicians and nurses) and future (the students)
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51 110 HCPs (26). However, we know little about HIV/AIDS-related knowledge, attitudes and infection
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54 111 risk perceptions of practising and future HCPs in India.
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112 **Objectives**

113 To evaluate the knowledge, attitudes and infection risk perceptions related to HIV/AIDS among
114 HCPs and healthcare students in the Ujjain district of Central India. Furthermore, to assess and
115 compare the impact of the ‘HIV-related stigma-reduction workshop’ intervention on the
116 participant groups using a pre-and post-intervention study design.

117 **Methods**

118 This intervention study was conducted between January 2016 and August 2016 at three colleges
119 of healthcare courses and two tertiary-care hospitals in Ujjain district in Madhya Pradesh state in
120 India. An approval was obtained from the ethics committee of R. D. Gardi Medical College,
121 Surasa, Ujjain, India, prior to the study. One of the hospitals is associated with a medical college,
122 a nursing college and a DMLT college and is referred to as the teaching hospital (TH). An ART
123 centre with specialized healthcare facilities for the PLWHAs is located at the TH. Another
124 participating hospital is referred to as the non-teaching hospital (NTH). In this study, the students
125 of Bachelor of Medicine, Bachelor of Surgery (MBBS), are referred to as medical students (27).

126 **Patient and Public Involvement**

127 There was no direct involvement of patients or the public in the present study.

128 **Participants**

129 The participants were practising HCPs, i.e. clinicians and nurses, and future HCPs, i.e. students of
130 medical, nursing and Diploma in Medical and Laboratory Technology (DMLT) courses, enrolled
131 in respective institutes in Ujjain district of Central India.

132 **Sampling strategy**

133 All groups of the HCPs and students were invited to participate in the workshop through various
134 means such as leaflets posted at the notice boards, announcements during lectures or meetings.
135 The leaflets were written in Hindi and English to offer equal chances for all potential participants
136 to learn about and attend the workshop to enhance their HIV/AIDS-related knowledge and ways
137 to stay protected at the workplace. The workshops were conducted at respective colleges and
138 hospitals to provide an equal opportunity to participate.

139 **Inclusion and exclusion criteria**

140 Participation was voluntary, and the participant could leave the session at any time without
141 experiencing any repercussions. The participants who could not attend or complete both the pre-
142 and post-workshop sessions were excluded from the analysis (Figure 1).

143 **Figure 1 Inclusion and exclusion criteria of the study participants Intervention**

144 *Structure of the workshops*

145 The intervention was designed as an educational workshop that suited best the local context. All
146 workshops were conducted by the same facilitators: a clinician and an officer-in-charge of the
147 ART centre at the TH (BLB), and the team leader of hospital infection prevention and control team
148 at the TH and the NTH (MS). In total, 13 workshops were conducted. Participants were divided
149 into smaller groups as follows: clinicians (two groups), nurses (five groups), medical students
150 (three groups), nursing students (two groups) and DMLT students (one group) to ensure that they
151 feel comfortable in the learning environment.

152 *Content of the workshops*

153 The workshop was two hours long and divided into three sessions: the first session consisted of an
154 animated video demonstrating the HIV infection epidemiology, the mechanism of viral
155 transmission, diagnostic testing, treatment options, how the ART drugs work and ethical issues
156 related to PLWHA and ART. This was followed by a second session that involved a PowerPoint
157 presentation focusing on topics such as the rights of PLWHA, the duties of HCPs and predictable
158 consequences due to stigma and discrimination against PLWHA. The third session was more
159 interactive and dynamic. Here, information about universal precautions and infection prevention
160 measures and control was provided, describing the importance of the use of standard precautions,
161 including hand hygiene in the daily routine. It was explained how and when to use gowns, gloves,
162 face shields, masks and goggles, and the availability of post-exposure prophylaxis (PEP) in the
163 study settings and the use of an in-house prepared alcohol-based hand rub (i.e. 'Micro *Kavach*')
164 was discussed (28). This was followed by the demonstration and practice of the WHO-
165 recommended hand hygiene techniques using 'Micro *Kavach*' (28). A period of 15 to 20 minutes
166 was assigned for an open discussion. The participants were asked to complete the questionnaire
167 twice: once before the workshop (pre-intervention) and then after the break (post-intervention).

168 **Data collection tool and analysis**

169 The context-specific questionnaires were developed locally and were used as pre- and post-
170 intervention data collection tools. The questionnaires were pre-tested in each potential participant
171 groups (not included in this study). After receiving feedback, the questionnaires were modified
172 and finalised, and brief educational intervention was designed considering the time constraints
173 among the participants (29). The questionnaires were formatted in both English and Hindi to

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3 174 facilitate the understanding of the questions by all participant groups. The questionnaires were
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5 175 divided into the five following sections: (1) participants' demographic information, (2) work
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7 176 experiences, (3) HIV/AIDS-related knowledge, (4) attitudes towards PLWHA, (5) risk perception
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9 177 and willingness to provide care to the PLWHA and patients with Hepatitis B.
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13 178 The responses related to the knowledge and attitude questions were scored in the following
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15 179 manner: each correct response in the knowledge section received a score of one, and each incorrect
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17 180 response received a score of zero. Scores of each individual were converted to the percentage of
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19 181 correct responses. Like in previous publications in this field; the levels of knowledge were
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21 182 categorised into "low" for the participants who scored $\leq 50\%$, "moderate" for those who scored
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23 183 between 51% and 74%, and "high" for those who scored $\geq 75\%$ (30).
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28 184 Responses to the questions related to participants' attitude towards PLWHAs were classified into
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30 185 three categories: positive (non-stigmatising), unsure, and negative (stigmatising) (31). A positive
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32 186 response was given a score of one and the responses where the participants were unsure or, where
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34 187 the responses indicated a negative attitude including fear, stigma, or intent to discriminate the
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36 188 PLWHA, were given a score of zero (32).
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40 189 Scores of each individual were added and converted to the percentage of correct responses.
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42 190 Responses, where the missing data was higher than 50%, were excluded from the analysis. Risk
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44 191 perception questions were categorical and dichotomised according to the outcome of interest for
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46 192 example (a) I am willing or not willing to care for a patient, or (b) I am at high risk or not at high
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48 193 risk of HIV exposure at the workplace.
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53 194 **Statistical analysis**

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3 195 The data on demographic and basic HIV-related information was presented as mean and standard
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5 196 deviations for continuous variables and as percentages and frequencies for categorical variables.
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8 197 The knowledge, attitudes and work environment variables were presented as median with
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10 198 interquartile range (IQR). The difference between the pre- and post-intervention scores were
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12 199 analysed using a Wilcoxon signed-rank test for continuous variables and McNemar's test for
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14 200 categorical variables. The score difference was calculated by subtracting the pre-intervention
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16 201 (baseline) score from the post-intervention score and represents the percentage unit increase or
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18 202 decrease concerning the baseline score. As these scores were not normally distributed, a Kruskal-
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20 203 Wallis test was conducted to determine a statistically significant difference among the participant
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22 204 groups in pre-intervention and post-intervention scores as well as the difference of scores. Post-
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24 205 hoc Dunn's tests were conducted to evaluate the relationship between the groups. The statistical
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26 206 significance was set at the level of $p < 0.05$. The data was entered in Epi info software (version 3.1)
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28 207 and Microsoft Excel and statistical analysis was performed using the Statistical Package for the
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30 208 Social Sciences (SPSS) and STATA 15.0 (Stata Corp. College Station, Texas, USA) software.

36 209 **Results**

40 210 **Baseline characteristics**

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42 211 In total, 920 people were invited to take part, and 746 (81%) voluntarily participated in the study.
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44 212 Of these, 650 (87%) attended all three sessions of the workshop and completed the questionnaire
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46 213 twice; 56% were students and 44% were practising HCPs. Thus, data from these 650 participants
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48 214 was included in the analysis (Figure 1).

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52 215 The mean age of the participants was 23 years, the majority were of the Hindu faith and 56% were
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54 216 males (Table 1). The proportion of participants who had received HIV/AIDS-related training

217 previously varied from 4% in the clinicians' group to 78% in the DMLT students' group. Only 2%
 218 of medical students stated that they had worked with PLWHA before. A high proportion of
 219 participants in each group reported experiencing accidental exposure to HIV or PLWHA. A range
 220 of 9% to 20% of the participants admitted discriminating against PLWHA in workplaces. Six (3%)
 221 of the medical students and up to 11% of DMLT students admitted that they had refused to provide
 222 care for PLWHA during their scheduled clinical visits, while between 17% and 28% of participants
 223 thought that their colleagues discriminated against PLWHA (Table 1).

224 **Table 1 Baseline demographic information (Part A) and experiences (Part B) of the**
 225 **participants.**

	Clinicians (n=75)	Nurses (n=211)	Medical students (n=205)	Nursing students (n=123)	DMLT students (n=36)
Part A: Baseline demographic information					
Age, mean (SD)	28 (4)	25 (6)	20 (1)	21 (3)	20 (2)
Sex, n (%)					
Male	30 (40)	148 (70)	109 (53)	51 (41)	28 (78)
Female	45 (60)	63 (30)	96 (47)	72 (59)	8 (22)
Married, n (%)	21 (28)	70 (33)	-	11 (9)	35 (97)
Religion, n (%)					
Hindu	62 (83)	192 (91)	183 (89)	120 (98)	31
Muslim	2 (3)	5 (2)	6 (3)	3 (2.4)	4
Christian	2 (3)	10 (5)	1 (0.5)	-	-
Other	9 (12)	4 (2)	15 (7)	-	2
Have you ever attended any HIV/AIDS related training? Yes, n (%)	3 (4)	39 (18)	63 (31)	28 (23)	28 (78)
Part B: Experiences of participants					
Have you ever cared for PLWHA before? Yes, n (%)	37 (49)	121 (57)	4 (2)	88 (72)	18 (50)
If Yes, how many times have you cared for PLWHA?					
Less than 10 times	29 (78)	59 (49)	2 (50)	61 (69)	5 (28)
Less than 50 times	2 (5)	27 (22)	-	14 (20)	8 (44)
More than 100 times	1 (3)	19 (16)	-	-	5 (28)
Cannot recall the numbers /too many	-	16 (13)	2 (50)	13 (15)	-
§Have you ever had an accidental exposure with body fluid of PLWHA, at work? Yes, n (%)	§4 (11)	§24 (20)	§3 (75)	§14 (16)	§1 (6)
Have you ever refused to care for PLWHA? Yes, n (%)	6 (8)	18 (9)	6 (3)	6 (5)	4 (11)
Have you discriminated against PLWHA at the workplace? Yes, n (%)	7 (9)	42 (20)	22 (11)	13 (11)	5 (19)
Do you think your colleagues discriminate against PLWHA? Yes, n (%)	21 (28)	45 (21)	51 (25)	28 (23)	6 (17)
Is your family aware that you ought to care for PLWHA patients as well? Yes, n (%)	49 (65)	134 (64)	127 (62)	100 (81)	16 (72)

Is there any family pressure regarding caring for PLWHAs? Yes, n (%)	15 (20)	46 (22)	16 (8)	15 (12)	8 (22)
Do you have any friend or family who is identified as PLWHA? Yes, n (%)	3 (4)	16 (8)	3 (2)	5 (4)	2 (6)
There is enough equipment to maintain universal precautions at workplace. Yes, n (%)	20 (27)	126 (60)	79 (39)	84 (68)	19 (53)
Have you ever had any accidental exposure to HIV through PLWHA at work? Yes, n (%)	4 (5)	24 (11)	3 (1)	14 (11)	1 (3)

226 Yes, n (%): Proportion of the participants who responded “Yes” to the questions asked
 227 DMLT= Students of Diploma in Medical and Laboratory Technology; Medical students= Students of Bachelor of
 228 Medicine, Bachelor of Surgery; PLWHA= people living with HIV/AIDS
 229 The boxes where totals do not add up to 100%, the remaining percentage of the participants did not respond to that
 230 question. §Proportion calculated from patients who confirmed that they have ever cared for PLWHA.

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Impact of the intervention on knowledge scores

234 The pre-intervention knowledge score, presented as the percentage of correct responses,
 235 demonstrated the low overall level of knowledge, with the poorest in DMLT students (22%) and
 236 the highest among the clinicians (45%, Table 2). The post-intervention knowledge scores ranged
 237 from 48% in the nurses’ group to 64% in the medical students’ group. The post-intervention
 238 knowledge scores were significantly higher than the pre-intervention knowledge scores ($p < 0.001$,
 239 Table 2), almost all groups reached a moderate level of knowledge. The difference between the
 240 knowledge scores of all study groups was statistically significant ($p < 0.001$). The knowledge scores
 241 of both medical and nursing students improved more than their respective practising HCPs. A
 242 pairwise comparison showed that at the pre-intervention stage, the clinicians had the highest
 243 knowledge level of all the groups ($p < 0.001$, Table 3). However, at the post-intervention stage, the
 244 medical students presented higher knowledge levels than the clinicians, while the knowledge of
 245 the nurses was the lowest.

246 Impact of the intervention on attitude

247 Evidence of a stigmatised attitude was observed among all responder groups. The lowest level of
 248 stigmatising attitudes at pre-intervention was found in the clinicians' group, where 79% responded
 249 to the questions without stigma. On the other hand, in the DMLT students' group, only 66% of
 250 responses presented a non-stigmatising attitude (Table 2). At post-intervention, the percentages of
 251 non-stigmatising responses were higher, ranging from 79% (lowest) among the nurses to 84% in
 252 the medical students' group. The attitude improved significantly across all groups, with a 3%
 253 increase in the clinician group and 17% in the DMLT students' group ($p < 0.001$). Overall, the
 254 intervention resulted in an improvement in stigma levels of up to 21%, as shown in the nurses'
 255 group. A pairwise comparison showed that medical students had the greatest improvement in their
 256 attitude (Table 4).

257 **Table 2. Pre- and post-intervention scores of knowledge and attitude among the participant**
 258 **groups**

Knowledge					
	Clinicians (n=75) % (IQR)	Nurses (n=211) % (IQR)	Medical students (n=205) % (IQR)	Nursing students (n=123) % (IQR)	DMLT students (n=36) % (IQR)
Percentage of correct responses					
Pre-Intervention, median (IQR)	45 (15)	30 (19)	29 (14)	30 (19)	22 (14)
Post-Intervention, median (IQR)	59 (14)	48 (26)	64 (21)	59 (26)	52 (17)
Difference	14*	18*	35*	29*	30*
Attitude					
Percentage of responses without stigma					
Pre-Intervention, median (IQR)	79 (18)	74 (15)	74 (18)	76 (12)	66 (35)
Post-Intervention, median (IQR)	82 (11)	79 (12)	84 (16)	82 (9)	83 (14)
Difference	3*	5*	10*	5*	17*

259 *Statistically significant differences with significance level $p < 0.05$.

260 DMLT= Students of Diploma in Medical and Laboratory Technology; IQR= Interquartile range; Medical students=
 261 Students of Bachelor of Medicine, Bachelor of Surgery

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264 **Table 3. Pre- and post-intervention pairwise comparison of knowledge between the**
 265 **participant groups**

Groups Compared	Pre-Intervention knowledge- Adjusted significance	Post-Intervention knowledge- Adjusted significance	Pre- and Post-Intervention knowledge- Adjusted significance
DMLT students- Nursing students	<0.05*	0.068	1.000
DMLT students - Medical students	<0.01*	<0.001*	0.629
DMLT students -Clinicians	<0.001*	0.116	<0.001*
DMLT students - Nurses	0.059	1.000	0.234
Medical students - Clinicians	<0.001*	0.051	<0.001*
Nursing students - Clinicians	<0.001*	1.000	<0.001*
Nursing students – Medical students	1.000	<0.05*	0.934
Nurses- Nursing students	1.000	<0.001*	<0.001*
Nurses- Clinicians	<0.001*	<0.001*	<0.05*
Nurses– Medical students	1.000	<0.001*	<0.001*

*Statistically significant differences with significance level $p < 0.05$.

Significance values have been adjusted by the Bonferroni correction for multiple tests. DMLT= Students of Diploma in Medical and Laboratory Technology; Medical students= Students of Bachelor of Medicine, Bachelor of Surgery

270 **Table 4. Pre- and post-intervention pairwise comparison of attitudes between the participant**
 271 **groups**

Groups Compared	Pre-Intervention attitude- Adjusted significance	Post-Intervention attitude- Adjusted significance	Pre- and Post-Intervention attitude- Adjusted significance
DMLT students - Nursing students	0.184	1.000	0.147
DMLT students - Medical students	0.479	0.614	1.000
DMLT students -Clinicians	<0.01*	1.000	0.134
DMLT students - Nurses	0.627	1.000	0.439
Medical students - Clinicians	<0.05*	1.000	<0.01*
Nursing students - Clinicians	0.252	1.000	1.000
Nursing students – Medical students	1.000	0.173	<0.01*
Nurses- Nursing students	1.000	0.614	1.000
Nurses- Clinicians	<0.05*	0.092	1.000
Nurses– Medical students	1.000	<0.001*	<0.05*

*Statistically significant differences with significance level $p < 0.05$. Significance values have been adjusted by the Bonferroni correction for multiple tests.

DMLT= Students of Diploma in Medical and Laboratory Technology; Medical students= Students of Bachelor of Medicine, Bachelor of Surgery

280 **Table 5. Risk perception reported by the participants in the pre- and post-intervention**
 281 **questionnaires.**

Questions	Time points	Nurses (n=211) n (%)	Clinicians (n=75) n (%)	Nursing students (n=123) n (%)	Medical students (n=205) n (%)	DMLT students (n=36) n (%)
Do you think you are at high risk for HIV/AIDS at work? Yes, n (%)	Pre-intervention	71 (34)	50 (67)	39 (32)	61 (30)	22 (61)
	Post-intervention	81 (38)	51 (68)	86 (70)*	82 (40)*	17(47)
Are you willing to care for- a) Patients with hepatitis B (Yes), n (%)	Pre-intervention	174 (83)	64 (85)	112 (91)	155 (76)	28 (78)
	Post-intervention	192 (91)*	65(87)	118 (96)	196 (96)*	32 (89)
b) PLWHA§ (Yes), n (%)	Pre-intervention	151 (72)	65 (87)	114 (93)	179 (87)	34 (94)
	Post-intervention	175 (83)*	66 (88)	110 (89)	183 (89)	30 (83)

282 Yes, n (%): Proportion of the participants who responded “Yes” to the questions asked

283 *Statistically significant differences with significance level $p < 0.05$. DMLT= Students of Diploma in Medical and
 284 Laboratory Technology; Medical students= Students of Bachelor of Medicine, Bachelor of Surgery; PLWHA= People
 285 living with HIV/AIDS. §The question was also classified as an attitude question.

286 **Impact of the intervention on infection risk perception**

287 Thirty per cent of the medical students and 67% of the clinicians perceived themselves to be at
 288 high risk of HIV infection in their workplace at the pre-intervention stage. The willingness to care
 289 for PLWHA was relatively high at the pre-intervention stage, ranging from 72% among the nurses
 290 to 94% among the DMLT student group. The proportion of the participants who were willing to
 291 care for people living with Hepatitis B was similar to those willing to care for PLWHA.

292 After the workshop, the medical and nursing students reported a significant increase in their
 293 awareness of the risk of HIV infection compared to their statements at pre-intervention. There was
 294 a significant increase in the post-intervention willingness to care for PLWHA in the nursing group,
 295 and a non-significant decrease in the DMLT and nursing students’ group (Table 5).

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297 **Discussion**

298 The present study evaluated the effect of ‘HIV-related stigma-reduction workshops’ and showed
299 that there was a significant improvement in HIV/AIDS-related knowledge in all groups who
300 participated in the intervention, irrespective of their inadequate baseline knowledge. Our study
301 highlighted the fact that stigmatising attitudes were widespread among practising HCPs and
302 students of various healthcare courses. However, stigmatising attitudes and discrimination that led
303 to an unwillingness to provide medical care to PLWHA were significantly reduced among the
304 participants after the intervention. The student groups showed more receptiveness to improve their
305 knowledge and attitudes towards PLWHA than the practising HCPs.

306 *Knowledge*

307 Low knowledge levels can perpetuate myths and misunderstandings that extend to baseline beliefs
308 and stigmatising attitudes. The present study showed that while the baseline HIV knowledge of
309 both the practicing HCPs and the healthcare students was inadequate, there was a significant
310 knowledge improvement in all participant groups after the intervention. These findings are
311 comparable with results from a cross-sectional survey conducted among practicing HCPs and
312 healthcare students in Uttarakhand, India (32). That study also found low levels of HIV-related
313 knowledge among HCPs and highlighted the need for improved HIV-specific education. Our study
314 echoed their finding that clinicians had more knowledge than the other groups. This is
315 understandable, as physicians are likely to receive more HIV-specific training than other types of
316 HCPs (33).

317 In our study, the overall post-intervention knowledge scores significantly increased in all groups,
318 and particularly so in the students’ groups. This was similar to the effect of educational

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3 319 interventions on HIV knowledge in two single-centre studies involving nursing students in
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5 320 Bengaluru and nurses in Delhi, India (22, 24). In Bengaluru, the intervention was divided into two
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7 321 one-hour sessions, while in Delhi it involved a two-day training program.
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11 322 We hypothesised that there would be a greater post-intervention increase in knowledge among the
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13 323 clinicians' group than the other groups. However, the students' groups showed significant
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15 324 knowledge gains and the clinicians showed the lowest increase. The theories suggest that
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17 325 knowledge is associated with baseline beliefs and attitudes, and depends on the readiness of the
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19 326 learners and their willingness to integrate the change into their behaviour (34, 35). As per the
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21 327 educational theory, the recognition of the gap in knowledge and skills, or the need for behaviour
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23 328 change, is essential for making the desired change (34, 35). The student groups, being in the
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25 329 learning phase of life, may have identified their gaps in knowledge, thus making them more
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27 330 receptive to the training than the other groups (34, 35), while the clinicians had adequate
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29 331 knowledge at pre-intervention and thus had less scope to improve their knowledge at the post-
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31 332 intervention stage.
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36 37 333 *Attitude* 38

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40 334 Stigmatising attitudes towards PLWHA can feed into a lack of desire or willingness to learn more
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42 335 about the disease. The present study confirmed our hypothesis that stigmatising attitudes are
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44 336 widespread among practicing HCPs and healthcare students in the region. Our pre-intervention
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46 337 stigma levels were higher in healthcare students and lower in practicing HCPs, which is consistent
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48 338 with a cross-sectional study of HCPs in Uttarakhand, India (33). Professional experience with
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50 339 PLWHA is a predictor of more positive attitudes towards them (14, 27). The higher levels of
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3 340 stigmatising attitudes found among participants (students) in our study could be due to incomplete
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5 341 or inadequate knowledge, and relatively less experience of working with PLWHA.
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9 342 Studies show that working on empathy-building techniques and including PLWHA testimonies in
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11 343 interventions can improve outcomes for HCPs and contribute to decreasing the stigma and
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13 344 discrimination towards PLWHA (36, 37). Recent studies demonstrate that small efforts such as
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15 345 support in the workplace, HCP-friendly policies and displaying stigma-reduction messages can
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17 346 change HCPs' attitudes towards PLWHA.
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21 347 Similar to the knowledge scores, the student groups showed larger improvements in their
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23 348 stigmatising attitudes than the working professionals. We must acknowledge, however, that
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25 349 although improvements in knowledge were seen in all groups, increased knowledge is not typically
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27 350 enough to affect changes in a person's attitudes and the baseline beliefs that contribute to stigma
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29 351 and discrimination. These changes are the result of a complex interplay between knowledge,
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31 352 baseline beliefs and attitudes that affects the readiness of the learners and their willingness to
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33 353 integrate the change into their behaviour (10, 34, 35).
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38 354 *Risk perception*

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42 355 Another highlight of our study was the willingness to care for PLWHA shown by the majority of
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44 356 HCPs and students at the pre-intervention stage. Our findings are in line with a study conducted in
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46 357 India by Kermode et al. that showed a relatively high willingness of HCPs to care for PLWHA
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48 358 despite the presence of stigmatising attitudes (7). However, there are few studies that assess risk
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50 359 perception prior to and after a stigma-reduction intervention.
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3 360 Medical and nursing students significantly improved their perception of HIV/AIDS risk in the
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5 361 post-intervention test. The same receptiveness to learning that was shown by the student groups in
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7 362 our study is likely to be the reason their knowledge in this area also improved. It must be said,
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9 363 however, that educational interventions may have a limited effect on risk perception if appropriate
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11 364 personal protective materials are not available in the workplace. This points to the necessity to
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13 365 create structural and policy changes that contribute to a safer work environment in conjunction
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15 366 with educational interventions in order to both reduce perceived and actual workplace risk (6, 7).
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17 367 Further studies are needed to determine the factors affecting HCPs' willingness to care for
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19 368 PLWHA.

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25 369 Our study is based on the call for new research that promotes the development of knowledge-
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27 370 building and stigma-reduction interventions to target the broad range of HCPs that PLWHA will
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29 371 encounter in their healthcare journeys (38, 39). The scaling-up of HIV stigma-reduction efforts
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31 372 lacks focus throughout the world, and especially in countries with a high HIV prevalence like
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33 373 India. The major challenge is the implementation feasibility of the interventions, mainly due to the
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35 374 time commitment and resources required.

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39 375 The number and duration of educational sessions does not necessarily correspond to greater
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41 376 increases in knowledge, and shorter interventions may suffice to bring participants to an adequate
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43 377 level of knowledge (38, 39). Researchers have used various time lengths to assess their
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45 378 intervention designs, and thus it is not appropriate to conclude there is a relationship between the
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47 379 length and number of workshops and the level of change (22, 24, 36, 40). However, it seems that
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49 380 even a short workshop can produce positive results, as seen by the progress of the students' groups
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51 381 in our study.

382 **Strengths and limitations**

383 To the best of our knowledge, this is the first study that presents knowledge and stigma in terms
384 of attitudes towards PLWHA among various groups of practising and future HCPs. Context-
385 specific low-cost educational intervention was feasible and appreciated by most of the HCPs
386 during both the pilot testing and the real study. Our intervention is brief and requires relatively few
387 resources and little time, which is important in settings where HCPs work. These features increase
388 the generalisability and feasibility of adopting the intervention design and applying it in other
389 similar settings where HCPs are burdened by a heavy workload.

390 This study shows that an educational and skills-based intervention, even if only for two hours, can
391 be effective in increasing knowledge and reducing stigmatised attitudes. Therefore, recurrent
392 training and educational workshops might have a sustainable effect of improved knowledge and
393 reduced stigmatised attitudes and behaviour towards PLWHA. Finally, the present study fills a
394 knowledge gap by providing a better understanding of the knowledge, attitudes and risk
395 perceptions of various HCPs and healthcare students in India and globally.

396 Like any study, this methodology must be seen in the context of its limitations. The major
397 consideration of our study is that the post-intervention questionnaire was completed after a short
398 break following the intervention. Thus, we could not validate whether the reduction in stigmatising
399 beliefs was sustained over time. The end goal of the intervention was to reduce stigmatised
400 behaviour. However, behaviour change is a long-term process and is complex to capture and
401 quantify; thus, we were restricted to capturing attitudes as a proxy. Although the present one-time
402 post-intervention data collection design presents a strong association between the intervention and
403 the results, additional follow-ups, for example at four weeks, six months and one year, would

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3 404 provide stronger evidence for the positive impact of the study on attitudes and knowledge than the
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5 405 current design.
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9 406 Given that the study was conducted in workplaces, the presence of social desirability bias in
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11 407 participants' stigma-related responses cannot be ruled out. Therefore, it is possible that the rate of
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13 408 stigma presented in the study is underestimated. The voluntary participation, with an emphasis on
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15 409 increasing knowledge, and the anonymous questionnaire completion, might have motivated HCPs
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17 410 to participate in the study.
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20 21 411 **Conclusions**

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24 412 Combating stigma is a key priority in achieving success in epidemic control and providing quality
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26 413 care to PLWHA. The findings from this study show that the HIV-related stigma-reduction
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28 414 workshops that are brief, feasible and relatively low-resource interventions, can successfully
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30 415 increase knowledge and reduce stigma in both HCPs and students. Considering the generalisability
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32 416 and feasibility of the intervention design, repetitive contextualised workshops with extended
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34 417 follow-ups are recommended to evaluate their impact and assure sustainable effect. We propose
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36 418 incorporating of more practical and integrated educational training in the teaching curricula of all
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38 419 healthcare courses. This will benefit the HCPs, PLWHAs and the community. Moreover, in future
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40 420 studies, we recommend the inclusion of a qualitative component and behavioural assessment to
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42 421 understand participants' attitudes and willingness to change stigmatising behaviour towards
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44 422 PLWHA.
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50 51 423 **Acknowledgements**

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4
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7 426 collection and data management.
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10 11 427 **Footnotes**

12 13 14 428 **Author contributions**

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18 429 MS and BLB perceived the study. MS and BLB designed the questionnaire and the content of the
19
20 430 interventions. MS and BLB conducted the training sessions and collected the pre-and post-
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22 431 intervention data. AM, CB and MS performed the analysis. AM and MS drafted the article. AM,
23
24 432 MS, BLB and CB gave critical comments to modify the manuscript. All authors gave final
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26 433 approval to the present version for publication.
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37 436 **Competing interests**

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40 437 Authors have no conflicts of interests to declare.
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43 438 **Ethical considerations**

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47 439 Ethical approval was granted by the ethics committee of R. D. Gardi Medical College, Surasa,
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49 440 Ujjain, India with letter numbers 311/17-07-2013 and 249/23-01-2013. Verbal and written
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51 441 consents were obtained from each participant before the study. Participants were assured by the
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3 442 researchers for full confidentiality. Participants were encouraged to respond to the questionnaires
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5 443 fearlessly and were ensured for no repercussions based on the responses.
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9 444 **A data sharing statement**

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11 445 All data generated during the study are included in the article. The data are not publicly available
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13 446 at present because it contains information that could compromise the confidentiality or consent of
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15 447 the study participants.
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19 448 **Patient consent for publication**

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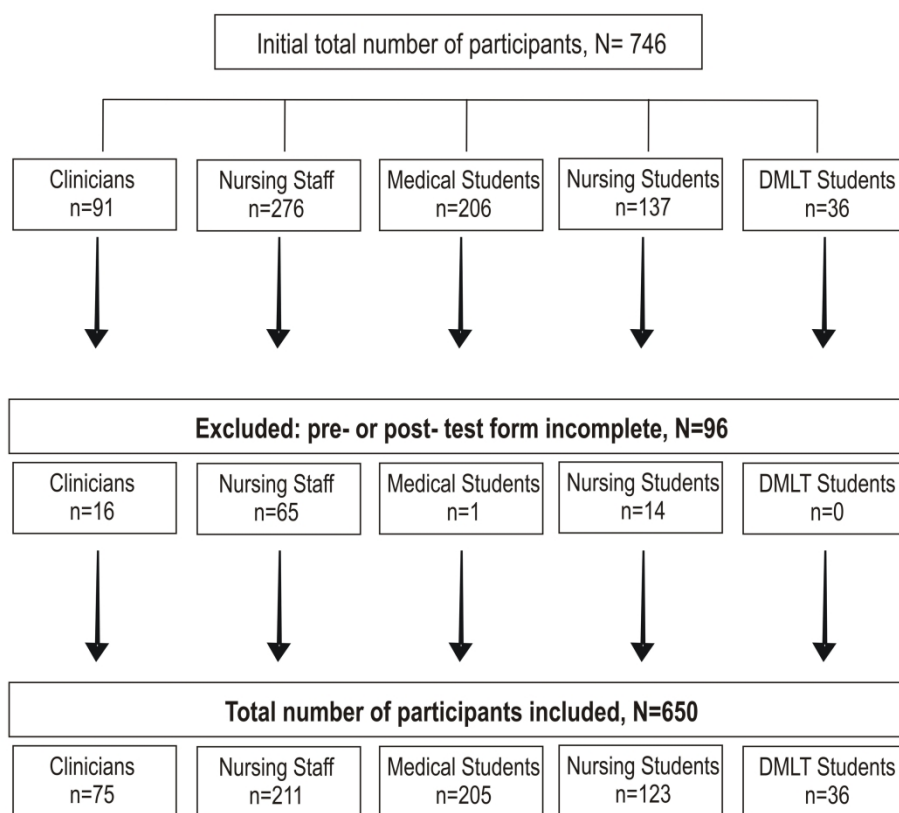


Figure 1 Inclusion and exclusion criteria of the study participants Intervention

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